Form ESA-B4. Public Report for ESA-172-2
Final

Company	PQ Corporation Inc	**ESA Dates**	December 18-20,2007
Plant	St. Louis (MO)	**ESA Type**	PH
Product	Chemical Minerals	**ESA Specialist**	D. Paul Mehta

Brief Narrative Summary Report for the Energy Savings Assessments:

INTRODUCTION:

ESA-172-2 was conducted for the PQ Corporation at their St.Louis (MO) plant. The ESA was conducted by the D. Paul Mehta in collaboration with Mr. Ted Fanson, process engineering at PQ Corporation Inc. St. Louis (MO). The team was joined by several other personnel from PQ Corporation.

PQ Corporation St. Louis plant has two major natural gas consuming equipment viz. Silicate Furnace and Gel Mill Furnace in addition to steam generating boilers. The Process Heat ESA did not cover the boilers because the Plant had a SSAT assessment a few days prior to the PH assessment. The Silicate Furnace mainly uses sand and soda ash to produce Silicates. This furnace was installed in 1926. Based upon the PHAST Analysis done during the SSAT assessment, it was estimated that this furnace uses about 212,500 MMBtu of natural gas. This furnace exhausts 6000 cfm of flue gas at a temperature of 873 F which is a good potential waste heat source for heat recovery.

The Gel Mill is an air heater which is used to dry the product to manufacture Silicate Gel. It had been estimated that the Gel Mill consumes almost 52,500 MMBtu of natural gas annually. Electricity consumption for operating this mill was also estimated by the Plant Personnel to be of similar amount. This mill exhausts almost 10100 cfm of air at 215 F with 19% oxygen content and discharges approximately 6735 lbm/hr of water vapors into the atmosphere. This exhaust air is a good source for water recovery.

Total annual electrical consumption at the plant was 5,877,606 KWH. Total annual natural gas consumption at the plant was 326,018 MMBtu.

Objective of ESA:

The main objective of the ESA was to understand the energy consumption patterns of the various direct fired heating equipment except steam generating system in the plant and to use this information to identifying Energy Savings Opportunities for the plant.

Focus of Assessments:

The focus was to apply PHAST to the Silicate Furnace and the Gel Mill with the purpose of identifying different components of energy consumption. This information was used to develop Energy Saving Opportunities for the plant.

Approach for ESA:

- Contacting Process Engineer Mr. Ted Fanson to set-up an agenda.
- Visiting the PQ Corporation Inc. in St.Louis December 18-20, 2007.
- Review of Plant Policies and Safety Instructions.
- Review of Plant Layout, Equipment, Processes etc.
- Plant walk through tour.
- Data collection for the various Direct Fired equipment.
- Process Heating Basics and PHAST review with the plant personnel.
- Demonstration of the use of PHAST software to the Plant Personnel.
- PHAST Analysis using the data collected.
- Discussing the potential performance and efficiency improvements.
- Discussion of Commercially available and Emerging Technologies applicable to PQ Corporation plant in St.Louis (MO).
- Wrap up meeting and distribution of the DOE's Literature on Best Practice and Tools.

ASSESSMENTS RECOMMENDATIONS:

1. Recover Waste Heat:

A waste heat source exists as the flue gas from the Silicate Furnace @ 600 cfm at 873 F. The heat can be recovered and used by installing a waste heat boiler. Steam generated by the waste heat boiler can be used at the extractor which uses 2000 lbm of steam per hour. During heating season, a part of the recovered heat could be used for space heating resulting in a lower cost of operation.

2. Implementing Oxygen Enrichment:

It is recommended that the commercially available Oxy-Fuel Firing and Oxygen-Enriched Air staging system should be considered for implementation at this plant. Previous PQ studies have shown these systems not to be economically feasible. Prime Fire 400: High Luminosity, Low NOx Burners are good candidates for implementation at this facility. Both the Silicate and Gel Mill Furnaces should be considered for using these technologies. It is estimated that almost 26,500 MMBtu of natural gas can be saved by using these technologies.

3. Implement Direct Digital Controls (DDC):

The air-fuel rate control system at the Silicate Furnace was installed in 2004 where as the system for the Gel Mill Furnace is much older. It is recommended that both the furnaces should be equipped with DDC systems to run the furnace with an optimal air-fuel ratio. It is estimated that implementation of this recommendation can result in an annual saving of about 39,750 MMBtu.

4. Replace Gel Mill Furnace:

The burners in the Gel Mill are about 14 years old. This Mill is basically is a hot air generator used to dry the product supplied by the Silicate Mill .Two burners are equipped with 1HP intake blower each. The intake air temperature is almost 70 F and it is heated to 1200 F before the product is introduced for drying. The wall surface temperature was measured to be 135 F. The hot air is transferred to the dryer section using a 125 HP fan. The product goes to the baghouse where approximately 10100 cfm of saturated air at 215 F are exhausted to the atmosphere. It is recommended to replace it with a new more energy efficient Mill (Burners, Fans, Motors, Duct system etc). Estimation of a minimum of 10% increase in efficiency of all the components of the mill not only the combustion components. Savings from increased productivity with the new Mill could also be of significant amount.

5. Pre-Heat Combustion Air:

The two burners at the Gel Mill are supplied combustion air at room temperature using 1HP blower each. It is recommended that this air should be pre-heated using the waste heat recovered from the Silicate Mill or the boiler. DOE literature suggests an increase in combustion efficiency of 15-30% using a conservative figure of 15%. Efficiency Improvement Calculator of the PHAST Program was used to figure out if a higher percentage in efficiency improvement was possible. It was found that in order to achieve efficiency improvement greater than 15%, increase in combustion air temperature should be more than 600F. Since such an increase in combustion air temperature was not possible by using either one of the waste heat sources at the plant, 15% increase in efficiency was used.

6. Reduce Wall Losses:

As mentioned earlier, wall surface temperatures were found to be in the range of 130 F (Gel Mill) to 300 F (Silicate Furnace). It is recommended to add insulation to the walls of the furnace externally to eliminate high temperature exposed surfaces and to save energy. This will cut down the losses by 5%.

7. Recover Waste Water:

Gel Mill exhausts 10100 cfm of saturated air at 215 F which amounts to 5.7 million gallons of water per year. It is recommended that a 30 ton conventional mechanical vapor compressor or absorption chiller be installed to condense and recover this water and use it at the extractor which uses 42 gallons/minute of water. Some of the recovered water can be used as make up water for the boiler. If absorption chiller is selected, it can use the waste heat from the Silicate Furnace. Ceramic Membrane based condenser was considered for recovering this waste water but was not found to be economically feasible.

It is estimated that the identified Near Term opportunities will save about 18% of the total natural gas consumption, Medium Term opportunities will save about 20%, and Long Term opportunities will save about 3% of natural gas consumption.

IDENTIFIED PLANT BEST PRACTICES:

Heat Recovery: Silicate furnace had regenerators to recover heat and use it for pre-heating the combustion air.

MANAGEMENT SUPPORT AND COMMENTS:

The plant contact person Mr. Ted Fanson was very co-operative and helpful. The Plant Manager and other Departmental Heads took a keen interest in the assessment. Ted Fanson had already loaded PHAST on his computer, used it for SSAT assessment, and was very helpful in entering the data.

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